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COAL ASH FUSION TEMPERATURES AND ITS TRANSFORMATION- A STUDY IN KSK MAHANADI POWER COMPANY LTD. NARIYARA, BILASPUR (C.G.)

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ABSTRACT

A mechanistic study is detailed in which coal ash is heated with its shrinkage measured continuously up to a temperature of 1600°C. The temperatures corresponding to the rapid rate of shrinkage correspond to the formation of eutectics identified on phase diagrams. Samples were therefore heated to these temperatures, cooled rapidly and examined using a scanning electron microscope (SEM) to identify the associated chemical and physical changes. The progressive changes in the range of chemical composition (from SEM), the extent of undissolved ash particles and porosity were then quantified and related to homogenisation, viscosity and ash fusion mechanisms. Alternate ash fusion temperatures based on different levels of shrinkage have also been suggested to characterize the ash deposition tendency of the coals.

Key words: Coal, Ash, Fusion Temperature.

INTRODUCTION

The behavior of the coal's ash residue at high temperature is a critical factor in selecting coals for steam power generation. Most furnaces are designed to remove ash as a powdery residue. Coal which has ash that fuses into a hard glassy slag known as *clinker* is usually unsatisfactory in furnaces as it requires cleaning. However, furnaces can be designed to handle the clinker, generally by removing it as a molten liquid.

Ash fusion temperatures are determined by viewing a moulded specimen of the coal ash through an observation window in a high-temperature furnace. The ash, in the form of a cone, pyramid or cube, is heated steadily past 1000 °C to as high a temperature as possible, preferably 1,600 °C (2,910 °F). The following temperatures are recorded;

- *Deformation temperature*: This is reached when the corners of the mould first become rounded
- *Softening (sphere) temperature*: This is reached when the top of the mould takes on a spherical shape.
- *Hemisphere temperature*: This is reached when the entire mould takes on a hemisphere shape
- *Flow (fluid) temperature*: This is reached when the molten ash collapses to a flattened button on the furnace floor.

The simplest test to evaluate whether a coal is suitable for production of coke is the free swelling index test. This involves heating a small sample of coal in a standardized crucible to around 800 degrees Celsius (1500°F).

After heating for a specified time, or until all volatiles are driven off, a small coke button remains in the crucible. The cross sectional profile of this coke button compared to a set of standardised profiles determines the Free Swelling Index [1-6].

Study Area

The samples of coal fly ash have been collected from M/s. K.S.K. Mahanadi Power Company Ltd. for the testing.

MATERIAL AND METHOD

This chapter records in a brief, the manifestation of the characterization of coal ash slurry like physical and chemical factors that affect the nature coal ash slurry. Various physico-chemical parameter/properties that affect the coal quality like, pH conductivities, Hardness,

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Chloride, Alkalinity etc. discussed in this chapter. Methods of sampling and analysis of water is used as prescribed in Indian standard [7-10].

RESULT AND DISCUSSION

The composition of mineral matter in Coal Fly Ashin Mahanadi Power can be seen from The mineral chemical composition of Indian coal includes the following main groups quartz pyrite calcite dolomite unknown groups and other minor mineral matter The most abundant mineral matter in Huainan coal is that of the aluminosilicate clay minerals with quartz They account for more than 60% of the total mineral matter in coal. Pure kaolinite melts more slowly than the other clay minerals because of the more restricted chemistry and the absence of cations such as K, Na and Ca. Therefore the AFT of a coal is mainly impacted by the contents of kaolinite in a coal sample and the contents of cations such as K, Na, Fe and Ca in minerals of coal (K, Na, Fe and Ca which are not in the structure of aluminosilicate). During the ash fusion process, quartz starts to dissolve slowly in the aluminosilicate matrix of coal ash. Although smaller quartz grains fuse and are assimilated in slag more readily, larger quartz grains may persist longer in slag phase. Therefore quartz is a main mineral matter in Coal [11,12].

CONCLUSION

1. IDT clearly does not represent the first fusion event.
2. T(25%) is found to be associated with significant particle deformation.
3. T(50) is related to formation of closed or spherical pores, which corresponds to >75% melt phase.
4. The temperatures corresponding to particular shrinkage events may be used as alternate ash fusion temperature.

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